

## 14. IMPACTS ON THE TOURISM SECTOR

**Águeda Esteban Talaya, Francisco López Palomeque and Eugeni Aguiló Pérez**

*Contributing Authors*

B. Gómez Martín

*Reviewers*

A. Huescar, R. Lucas, O. Perelli, F. Prats, F. Vera

A. Perry



## ABSTRACT

The *sensitivity of the tourism sector to climate* is very great in Spain, as our good climate conditions, especially on the Mediterranean coast, are a decisive factor in relation to the geographic areas of choice, activity schedules, tourism infrastructures and the functioning of these and the conditions of enjoyment and wellbeing of the tourist, as well as being one of the main elements of attraction in our country.

The *impacts of climate change* will affect, in the first place, the *geographic-tourism space*, and can cause alterations in the ecosystems involved, which are already in a fragile state, bringing to a halt the social, economic and environmental benefits that have been enjoyed up to now. Water scarcity will cause problems related to the functionality or economic feasibility of certain destinations. Temperature rises could modify activity schedules. A rise in sea level would threaten the current location of determined tourist settlements and of their infrastructures. These changes will have a greater impact in the more deteriorated areas, with a serious imbalance and greater conjunction of the different climatic effects. The *most vulnerable areas* to climate change are along the coast (with a high degree of human intervention), these forming Spain's main sun and sand tourist attraction, and mountain areas, above all in relation to snow tourism.

The *tourism demand* most affected is that related to recreation and holiday tourism (the main type in our country). Tourists will modify their behaviour, reducing their average stay in each destination, delaying the moment in which they decide to travel, and changing their destinations in the case of tourists from abroad, who will remain in their own countries, and in relation to national demand, they will travel to the northern coasts or inland. There may also be an increase in inter-season trips (spring and autumn).

With regard to the *tourism offer*, the biggest impact will be felt by the establishments providing accommodation and the incoming travel agencies at the most affected destinations, with serious economic consequences, especially for those destinations depending heavily on big investments in infrastructures. The most serious consequence for the economy as a whole would *involve reduced income from tourism*, and for the most vulnerable areas, as these suffer from a big imbalance, a foreseeable transformation of the medium and long-term economic conditions thereof and, in the worst of scenarios, the progressive closure of tourism and non-tourism establishments, increased unemployment and the financial ruin of the destinations.

There is great *uncertainty* with regard to the evolution of tourism, and we are unaware of possible variations in the behaviour of demand caused by climate change, or the quantitative level of the impact involved, especially with regard to the loss of a feeling of comfort and safety by the tourists, or the loss of attractiveness of a destination or a travel season. The *possibility of detecting the change* is very limited at present, and the *generation of indicator systems* is vital with regard to indicating and differentiating types of impacts according to types of areas and tourism products, especially coastal and mountain ones. Furthermore, *research needs* in respect to the relationship between climate change and tourism require opening and maintaining *a specific line of research project funding*, with specific programmes dealing with this theme, to be integrated within the National Plan for Research and Development and Innovation (NP R+D+I).



## 14.1. INTRODUCTION

### 14.1.1. Uniqueness and demarcation of tourism

Tourism is a complex system which is difficult to delimit, as it comprises a set of different activities of an economic, social, geographic, cultural, sports, environmental and institutional nature. Furthermore, the tourism system is of a transversal and heterogeneous nature, and this makes it unique in a certain way as an activity, due to its close relationship with:

- *Economic factors*: accommodation, transport, food, real estate sector and other complementary goods and services of potential use to tourists.
- *Social factors*: mainly related to the use and enjoyment of leisure time, together with contact with other social spaces and their customs and lifestyles.
- *Natural factors*: referring to the physical environments, like coasts, mountains, inland spaces or those related to protected natural spaces, which are the main components of tourism resources. Climate is a key element of the natural environment in which tourism is developed.
- *Cultural factors*: highlighting the presence of cultural heritage as a tourist attraction.
- *Political factors*: due to the involvement of public institutions in both investment in infrastructures and in promotion of tourist resorts, as well as in the direct participation in regional planning.

The *tourism system* is made up of *four basic elements*: the geographic-tourism *area*, the *demand*, the *offer* and the *agents*. All the fundamental factors and elements interact within a determined institutional and legal framework and in one same location: the *tourist destination*, in which the resources are shared for a determined period of time, which, together with the services used, comprise the tourism offer. Space and time are the two main components of tourism.

### 14.1.2. Current situation of tourism in Spain

It is well known that Spain has a highly specialised tourism industry, and over the last four decades has become a basic destination for the more developed European countries, and to a lesser extent, of other OECD countries. In fact, together with the United States and France, Spain vies for first place in world tourism, according to figures provided by the World Tourism Organisation (WTO) which indicate that our country receives 7,5% of the 694 million international tourists throughout the world, estimated for the year 2003.

Other countries appearing in the Mediterranean are now competing with the more traditional destinations in Spain, France and Italy. Among these, we can highlight Greece, with 14 million tourists, Turkey with 12.8 million and Croatia with 7 million in the year 2002, as emerging competitors undergoing inter-annual growth rates higher than in the more traditional countries.

Tourism in Spain is characterised by the volume of demand from the tourism markets involving both residents from foreign countries coming to our country and Spaniards themselves. The most noteworthy aspects of the tourism demand are the reasons for the trip, the destination chosen and the use of accommodation and transport, mainly.

The main flows of *inbound tourism demand* from the international market in Spain during the year 2003<sup>1</sup> are:

<sup>1</sup> The main sources of data on demand are: in physical terms, the Instituto de Estudios Turísticos (institute of tourism studies) belonging to the Secretaría General de Turismo (tourism dept.); in monetary terms, the Bank of Spain, and in relation to hotel accommodation, Instituto Nacional de Estadística (national statistics institute).

- The *foreign visitors crossing our borders* are estimated at approximately 82,6 million.
- The segment of *tourists* (visitors for at least 24 hours) constitutes 63.6% of total visitors, that is, approximately 52.5 million.
- *Revenue from tourism* (according to information supplied by the Bank of Spain) came to a total of 36,871 million euros.
- Foreign visitors accommodated in hotels comes to 27.3 million.
- *Overnight stays* by travellers residing abroad rise to 136.8 million nights.

Considering the effects of climate, it must be kept in mind that of the 52.5 million tourists in Spain, around 40 million come from Central and Northern Europe, and their main reason is to come to a sunny climate close to the coast, a more suitable definition than the traditional sun and sand.

To the demand from abroad, we must add *internal tourism* with big demand flows, which can be of greater quantitative relevance in certain areas than that provided by international inbound tourism. Travel by Spaniards constitutes a big quota of the Spanish tourism market, as their travels are mainly on national territory (Esteban Talaya 2003). The main flows of *tourism demand by Spaniards* during 2003 are:

- Spaniards made a total of almost 129.2 million *trips*.
- *Short trips* to holiday homes which are a very high percentage of the total: 65.25%, with 84.3 million trips.
- The remaining *trips*, called *tourism trips*, amount to 44.9 million.
- *Payments for tourism* made by Spaniards abroad amounted to 7,315 million euros.
- Spanish tourists *accommodated in hotels* in Spain totalled 35.2 million euros.
- The total amount of *overnight stays* made by Spanish travellers in hotels in Spain rises to 91 million nights.

From the *point of view of offer*, Spain has a high number of companies and establishments, making up a highly fragmented and atomised sector, with a wide range of activities. Some interesting representative data on the main subsectors are the following:

- 17,000 hotel establishments with accommodation for approximately 1.4 million.
- 1,200 camp sites, with around 770,000 places.
- 127,000 regulated apartments, with 400,000 bed-places, although dwellings for potential use for tourism are estimated at approximately 5.5 million.
- 9,000 travel agencies, between head offices and branches.
- Another offer: 29 ski resorts, 112 spa resorts, 245 golf courses, 845 national Parks and Protected Natural Areas.

#### 14.1.3. Identification of spaces and tourist destinations

One of the basic features of tourism in Spain is the *diversity* and the *abundance of its resources*, the exploitation of which has given rise to processes of tourism development differentiated in time and in space and to the creation of a large number of products which have shaped an asymmetric map of tourism, in which spaces are identified with unequal intensities in relation to tourism, and which are qualitatively different. Indeed, the exploitation of resources governing the spatial location of tourism is what enables us to differentiate the environments or territorial scopes that are shaped by the tourism function (Vera *et al.* 1997).

At an *initial level of identification* of tourist spaces and destinations in Spain, we refer to the consideration of *geographic environments*, defined both by the nature of the components of the environment and by their territorial function, in each case. Among the geographic conditions

outlining the features of these environments, is climate, in first place, which gives peculiarity and diversity to them. The result is the identification of *four environments* which constitute an initial tourist zoning system: *the coastal area*, the *mountain area*, the *rural area* and the *urban area* (López Palomeque and Vera Rebollo 2002).

In Spain, the *coastal tourism area* has been very important since the beginning of mass tourism, and it must be kept in mind that the coast is the environment that houses the biggest offer and the biggest movement of tourists, and which therefore shows the greatest effects of the transformation and restructuring of the territory. The Spanish coastline stretches for 3,904 kilometres on the peninsula and 2,036 kilometres on the islands, which, however, present differentiated environmental conditions and different attractions and possibilities for tourism. In the contrasted realities of tourism and in the different potentialities of this coastline, climatic diversity undoubtedly plays an important role in this environment and throughout the whole country. Initially, in Spanish climatic diversity, we can distinguish the following climates: the Mediterranean climate – with its wide range of nuances and transitions –, the Atlantic climate, the continental climate and the mountain climate.

Apart from the importance of coastal tourism, it must be pointed out that tourism and recreational activities in *urban, rural and mountain areas* have become notably developed, in consonance with the new tendencies of demand, and have been favoured by the responses of the different agents, public and private. This newly found appreciation of the natural and rural environments has opened up new perspectives for tourism as an instrument for the development of economically depressed areas, whereas the urban areas constitute leisure and tourism scenarios, associated with culture and with the global offer, differentiated in each city, allowing for strategies related to the model and the renovation of urban scenery and image (Vera *et al.* 1997). As a result in recent years –and also as a prediction for the future– diversifying tendencies can be seen in the location of tourism, which have important consequences of a territorial, economic and social nature. This process leads to the spatial spread of tourism throughout the whole territory (spatial generalisation of tourism or “touristification” of the territory), a phenomenon which is more observable at intermediate scale (López Palomeque and Vera Rebollo 2002).

Consequently, as an operative outline for this report on the impact of climate change on the Tourism Sector, we have chosen to consider as a *basic zoning system* of reference the four aforementioned environments. On a map of Spain it is easy to identify schematically the four tourism environments, although this scale of analysis presents a degree of abstraction that hides the heterogeneity and specific problems of each one of them, from both the formal and the functional perspectives, and above all, with regard to their environmental contrasts and climatic diversity. And it also hinders the analysis of the differentiated potential impact of climatic change on the different environmental zones of one same environment.

In order to deal with the coastal area, the following zones were considered: the Mediterranean coast (northern, central and southern), the Atlantic coast (Cantabrian, North Atlantic and South), the Balearic Isles and the Canary Isles. For the treatment of the rural area, we refer in each case to the most noteworthy geo-tourism zones of inland Spain; in the case of the mountain area, we considered the biggest massifs, accommodating snow-based tourism, and in relation to the urban space, mention is made of the most significant cities housing Spanish tourism. It must be added that, in using this zoning system, greater attention will be paid to those zones most vulnerable to climate change, and greater priority will consequently be given to references to the *coastal zones and products* (see section 14.4.2) and to the *mountain zones and products* (see section 14.4.3).

Besides, this zoning is completed, where necessary, with considerations of other types of spatial units in each one of the environments. On one hand, the *geotourism zones*, drawn up according to different circumstances, from purposes of business operativeness, image or

promotion of tourism policy, to the existence of certain spatial relationships and components, giving the territory the category of functional specialisation or a homogenous nature. For instance, on the coast, the Costa Brava, the Costa Daurada, the Costa Blanca or the Costa del Sol, among others. On the other hand, *political-administrative regions* –the Regional Autonomies- understood in this context as tourism “regions”. The consideration of the Regional Autonomies is based on *two factors*:

- In general, due to the importance of the public administration as an agent that manages the tourist area.
- In particular, with regard to the theme of the effects of climate change on tourism, it will be, to a great extent, the public powers that have to take the decisions and implement the actions.

#### 14.1.4. Impact of tourism on the economy

As has already been pointed out, international tourism contributed, in the year 2003, 36,800 million euros, which showed a growth of 3.7% compared to 2002. In global terms, the influence of tourism on the national economy is relevant, in aspects such as contribution to the Gross Domestic Product (GDP), to the creation of employment and to covering the commercial deficit in the Balance of Payments. The following are some data representing the importance of this aspect:

- The *contribution of tourism to the GDP* in 1999 amounted to 12%, with an increase of over one point in three years.
- The estimates of *tourism spending* amounts to a total of 77,500 million euros, of which approximately 50% comes from spending by Spaniards.
- Spending on tourism in Spain is basically concentrated on *accommodation and restaurants* with approximately 60% of the total.
- In the year 2003 revenue from tourism was 77.4% of the *cover of the trade deficit*.

With regard to employment, in the year 2002, the people paying social security corresponding to the subsectors of the tourism sector amounted to over 2 million *jobs* which is 12.5% of employment of all the sectors of the national economy. If we take into account that the dependence on tourism of the other economic sectors, i.e. agriculture, industry and, above all, services, is very great, we must conclude that, through these multiplying effects, a very significant part of Spain’s economy is linked to the evolution of tourism.

Considering that, by definition, tourism involves moving from one place to another, the primordial role played by the *new information and communication technologies* is essential in order to connect a demand and an offer separated from each other in space. This same fact also involves significant temporal increases in population that needs to be supplied with a big amount of infrastructures and services, which makes it even more complicated for the sector to function, but which, in turn, contributes to creating revenue and employment in these activities.

Considering the predominance of “sun and sand” tourism, one can observe a *growing segmentation of the market*, which in relation to the effects of climate change is of great interest, due to the fact that the impact will affect one type of tourism more than another. If each type of tourism generates different spending capacities and different multiplying effects, it is essential to learn of the positioning and evolution of the different markets. At the same time, some zones or tourist destinations, mainly the traditional ones, depend almost exclusively on tourism for the development and evolution of their local economies, because the rest of the areas are subordinated to the inflow of tourists.

The importance of tourism in Spain’s economy is limited to figures of a very general nature, like the aforementioned ones, which does not facilitate a detailed analysis of the influence of



determined “*shocks*” in the sector as a whole and in the different subsectors it is composed of. Consequently, there is an increasingly urgent need to avail of economic and tourism indicators that go beyond data related to tourists, which would enable us to value better profitability according to types of products, countries of origin and destinations.

## 14.2. SENSITIVITY TO THE PRESENT CLIMATE

The influence of climate on tourism can be seen at *three levels*, because climate can act as a factor for locating tourism, as a resource of tourism and as a tourist attraction (Gómez Martín 2000, 2004d, 2004e):

- *Climate as a factor of location of tourism.* Climate is a geophysical or natural element of the geographic space considered as a factor for locating tourism, on intervening in the processes of functionality of a territory. That is to say, climate as an element of the geographic space is not neutral, but rather presents certain differential characteristics, which sometimes prevent, sometimes hinder and other times favour the establishment of tourism. In this sense, in Spain the creation of many of the existing tourist resorts has been governed by the desire to make the best of certain favourable local and regional climatic conditions (Gómez Martín 1999a, 2000, Vera Rebollo 1985).
- *Climate as a tourism resource.* Climate exists outside any considerations related to tourism, but it becomes a resource of tourism as soon as it is incorporated into a tourism commodity or service, these being promoted for consumption and used for commercial purposes through any channel of communication and marketing, always in order to satisfy the latent requirements of demand. Climate as a resource of tourism is considered to be fundamental when without it, it becomes difficult to develop and consolidate determined tourism activities in a territory (activities depending on climate and weather). Furthermore, climate is considered to be a complementary resource when it does not determine the tourism activity itself and becomes a subsidiary element of other resources (activities sensitive to climate and to weather). In Spain, it is the tourism activities and modalities depending on atmospheric conditions that generate the biggest flows of tourists (sun and sand, snow-based tourism, sailing...). In fact, many of the tourism products on offer incorporate this element as a basic input, that is to say, the natural environment, demonstrating the high potentiality of climate as a tourism resource (Gómez Martín 2000).
- *Climate as a tourist attraction.* Including climate in the tourism product goes further than simply considering it as “raw material” , as on many occasions it becomes an element capable of bringing quality into tourism: atmospheric conditions can help the tourists to carry out their activities in optimum conditions of enjoyment, safety and comfort. This is why climate often becomes an attraction factor, that is to say, an attribute or characteristic of the tourism product or destination which is decisive at the moment of purchase by the tourist. This is one of the reasons why climate is included in the pictures of the destination, and why it plays a key role in the promotion of tourism. Analysis of the verbal and iconic information on tourist brochures shows the constant direct and indirect reference to climate, confirming its role as an attraction factor (Gómez Martín 1999b, Olcina Cantos and Vera Rebollo 1998).

These and other theoretical facts related to the importance of climate as a factor of tourism location, resource and attraction are specified in certain specific aspects of the reality of Spanish tourism (Perry 1972, Mings 1978, Baretje and Crespo 1992, Smith 1993, Maddison 2001). Thus, the *main aspects of the relationship between climate and tourism* are (Gómez Martín 2000, 2004d, 2004e):

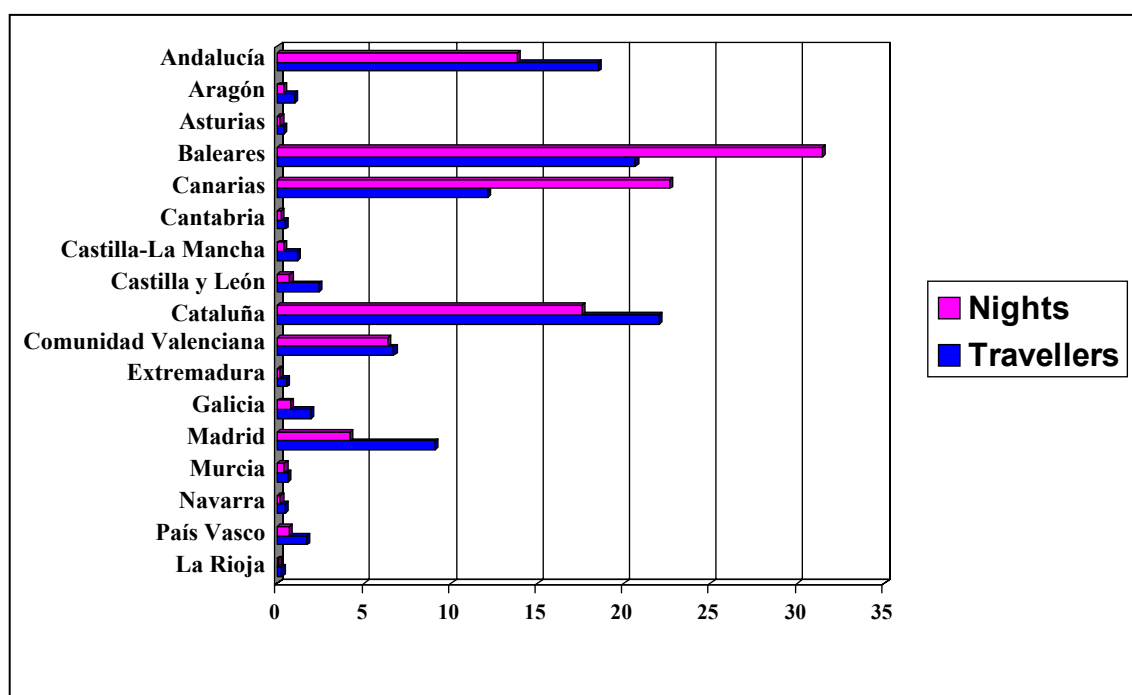
**14.2.1. The climates of Spain affect the type of environmental framework in which tourism is to be developed, constituting in most cases spaces that are attractive and functional for tourism.**

Thus, there is a high geographic concentration in the tourist destinations of the Mediterranean coast, which are highly specialised in tourism and sun leisure products, due to the optimum conditions therein for these activities (see Figures 14.1 and 14.2). A total of 55.3% of tourists residing abroad prefer the Regional Autonomies of Catalonia, Balearic Isles and Andalusia to spend their holidays. Likewise, 45.6% of Spaniards holiday in the Regional Autonomies of Andalusia, Valencia and Catalonia. The same occurs with the Canary Isles (20.6% of foreign tourists prefer this destination). In any case, there are *areas on the Mediterranean coast* (SE part) affected by certain extreme climatic characteristics that constitute *fragile systems*, often affected by conflicts and problems related to functionality (Perry 2003).

**14.2.2. Climate has a great influence on the establishment of schedules for tourism activities.**

In this sense, it must be pointed out that although the schedules of climate-tourism potentiality in most Spanish destinations present long and favourable periods which could affect *deseasonalisation* (Gómez Martín 2000, 2004a, Gómez Martín *et al.* 2002), there is great temporal concentration of demand at global scale. Thus, 48.8% of national trips are concentrated in the months of July, August and September (see Figure 14.3); 56% of the trips related to inbound tourism are concentrated in the months of June, July, August and September.

**14.2.3. The weather affects activities related to tourism and their scheduling, especially if they are practised in the open air (De Freitas 2001).**



**Fig. 14.1.** Distribution of foreign tourists in hotels according to regional autonomies (%) – 2003. Source: Own design based on data from the National Statistics Institute

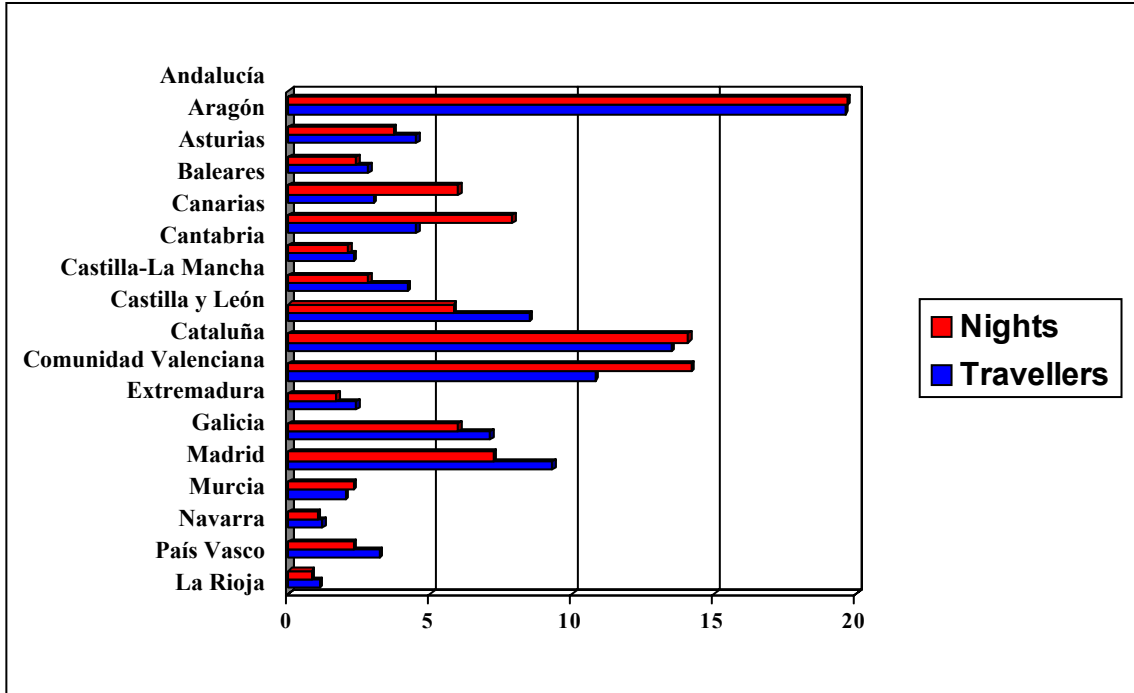


Fig. 14.2. Distribution of spanish tourists in hotels according to regional autonomies (%) – 2003. Own design based on data from the National Statistics Institute

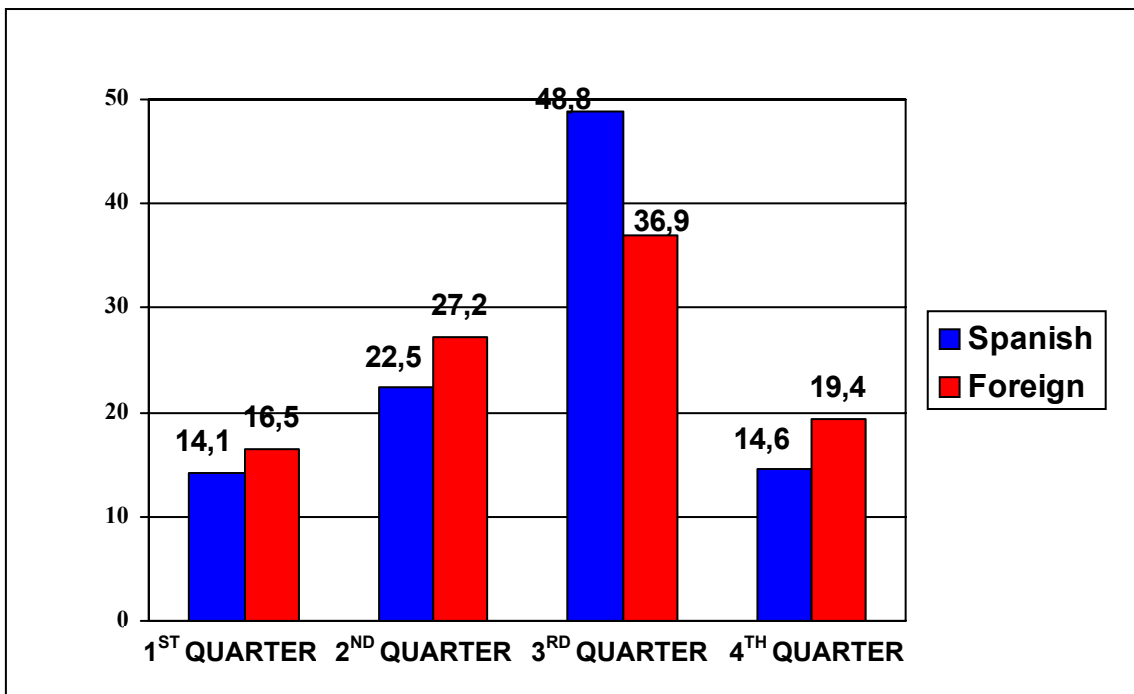


Fig. 14.3. Distribution of foreign and spanish tourists per three-month period (%) – 2003. Source: Own design based on data from the Instituto de Estudios Turísticos (Tourism Studies Institute)

#### **14.2.4. Climatic and meteorological conditions affect the buildings and infrastructures of tourism**

Not only climate and weather mean that a place will be frequented by tourists or not, but also how they are received and how much they enjoy their stay, the accommodation (in Spain, and especially in the Mediterranean sector, climate favours a variety of types of accommodation: from camp sites to other forms of accommodation less sensitive to the weather), the tourism architecture itself, the preparations that have been made and even urban design itself (Spanish town planners are aware of the importance of the beneficial effects of the suitable use of gardens and of certain elements of urban furniture – awnings, canopies, etc.- in fitting out outdoor spaces for tourism) (Gómez Martín 2004d, 2004e).

#### **14.2.5. Climatic and meteorological conditions have a great influence on the functioning of transport and communications, facilitating and conditioning travel for tourists**

#### **14.2.6. Climatic and meteorological conditions affect the tourists' feeling of safety**

In this sense it should be pointed out that *a high risk of climatic catastrophes and natural catastrophes in general is incompatible with any type of tourism activity*. In Spain, extreme events linked to climate must not be underrated and are an important factor to be considered in planning. In any case, observation shows that the risk and/or catastrophic nature of many episodes depends on the adequacy or inadequacy of human intervention in the geographic space (incorrect location of tourist infrastructures and facilities, especially in vulnerable points, like coastlines, riverbanks and mountain slopes) (Gómez Martín 2004a, 2004b, 2004c, Olcina Cantos 1994).

#### **14.2.7. Climatic and meteorological characteristics make up the environmental conditions and affect the tourists' perception of enjoyment and comfort (feeling of wellbeing), as well as their health**

Under normal conditions, the climates affecting the peninsula and the islands constitute healthy and comfortable environments for tourists. In any case, the Mediterranean and the inland part of the peninsula are occasionally affected by extreme episodes during the holiday period (in particular, heat waves) which alter the conditions of comfort, affecting in the short and medium term the frequency of visits by tourists.

#### **14.2.8. The climatic and meteorological conditions of an area are often offered as a tourist attraction**

Although each tourist activity requires its own climatic and meteorological conditions, these being a factor that attracts tourists, these seem to have a particular taste for sunshine and relatively high temperatures (environmental comfort): most of them like to carry out their activities (whatever these may be) in places characterised by mild temperatures and a lot of sunshine: So for British tourists, for instance, the fundamental factor in the choice of Spain as a destination is the climate, especially among those who say they have come on holidays. The same thing happens with tourists from other countries. These same preferences can also be observed according to modalities of tourism (Gómez Martín 2000).

Most Spanish tour operators, aware of these preferences by the tourists, incorporate climate as an attraction into the image of the product, because they know that this can affect the buyer when choosing his destination. So, for example, inspection of Spanish tourism brochures shows a noteworthy presence of atmospheric elements both in the iconic information (logotypes,

photographs and illustrations) and in the verbal information (text, statistical tables, slogans and headlines) contained therein (Gómez Martín 1999a, 1999b).

#### **14.2.9. Climatic and meteorological conditions affect the tourists' degree of satisfaction**

Certain climatic and meteorological conditions that allow the tourist to carry out his activities with a high degree of safety, comfort and enjoyment contribute to satisfying his initial requirements, and therefore, to raising his degree of satisfaction. Thus, for example, we can see that in the study by the Secretaría General de Turismo (tourism dept.) *Degree of satisfaction of demand by national and foreign tourists in relation to the Spanish tourism product (1991)*, "sun and climate" are among the elements that most impressed the tourists due to satisfying their needs: 89% of answers by Spanish tourists showed a good or very good impression of the climate-weather recorded (a very high score in the scale of satisfaction); among the foreign tourists, this score rose to 93.1%. In any case, the results of surveys throughout the years are subject to the whims of nature (Gómez Martín 1999b, 2004d, 2004e).

### **14.3. FORESEEABLE IMPACTS OF CLIMATE CHANGE**

#### **14.3.1. Climate change and the tourism system**

The relationship between elements of the weather and tourism have traditionally been approached within a framework of natural variability, because it was considered that climate was a special natural tourism resource among natural tourism resources, due to being renewable and non-degradable. However, the publication in 2001 of the Third Evaluation Report by the IPCC (International Group of Experts on Climate Change) has shown and confirmed that *atmospheric resources are also subject to modifications* resulting from certain human activities. This recognition of climate change due to anthropic causes has led the traditional climate-tourism relationship to be reconsidered, but now within a context of change and uncertainty (Gómez Martín 2004e).

Considering that the *tourism system* is made up of four fundamental elements (the geographic – tourism area, demand for tourism, offer of tourism, and the market operators), it is logical to think that they can all be altered, directly or indirectly, by the phenomenon of climatic change. It can therefore be expected that the first element to be affected by this phenomenon will be the geographical-tourism space itself, and consequently, and in this order, demand, offer, and the market operators. In any case, this logical sequence can be altered to respond to climatic change, without casting any doubt upon the tourism sector. It is clear that the Spanish tourism system has proven its capacity for adaptation: it is *a dynamic system capable of generating responses*, and more so if we consider that in this case the change is slow and therefore allows for planning and intervention in time in relation to the different elements of the system in order to counteract any possible derivative effects (Gómez Martín 2004e). However, the degree of degradation that can be seen in certain traditional tourist destinations shows little margin for manoeuvre and any change could worsen even more the current conditions, which are already out of balance.

#### **14.3.2. Repercussions in the geographical-tourism area**

Climate is a natural or geophysical element forming part of the geographic-tourism space. Any modification thereof could generate changes in the rest of the geophysical or geo-human elements making up this variable of the tourism system, changing an initially attractive and efficient space into a space lacking in resources, attractiveness and functionality.

Climate change is expected to cause *reduced rainfall* (even more serious in the south of the peninsula) and *increases in its inter-annual variability*. Likewise, *temperatures will foreseeably rise*, especially in summer, and it is more likely that there will be more *extreme climatic events*. These changes may generate a series of *repercussions in the geographic-tourism area*, because:

- Alterations may be caused (significant changes in regional limits or degradation-disappearance) in some of the *ecosystems* characterised by a high number of ecological habitats and an appreciably high percentage of world biological diversity. These natural spaces distributed throughout the peninsula and the islands, traditionally considered as attractive spaces from the tourism point of view, may suffer alterations with regard to ecological and aesthetic qualities, fragility and in general, tourism-recreational values, *ceasing to provide social, economic and environmental benefits*.
- Changes can occur in the *global hydrological cycle*, generating serious impacts on the regional and temporal distribution and availability of water. The decreased water reserves may lead to problems economic functionality or feasibility in many current tourist sites, especially those located on the Mediterranean coast and in the Balearic and Canary Isles.
- Notable changes may occur in the areas currently dedicated to *winter tourism*. The complexes situated below 2,000 metres may disappear or reconvert to other tourism modalities (although this limit may vary latitudinally), due to the disappearance or scarcity of the snow resource. The ski resorts will be forced upwards in altitude and they will have to increase investment in cannons for the production of artificial snow. In any case, the irregularity of snowfall and the decreased temperature resulting from the delay in the appearance of the snow layer and the premature worsening of the quality of this in springtime, do not guarantee the profitability of investments in determined geographic areas.
- In inland and coastal areas, changes may be generated in the *activities scheduled* due to worsened climate-tourism conditions in the mid-months of summer due to excessive heat and an increase in the potentiality of the inter-seasons (spring and autumn). Something similar could happen in determined mountain areas, although in the opposite sense: the shortened winter season due to a lack of snow might be compensated by the lengthening of the summer season.

Global climatic change will foreseeably cause an *increase in sea level* in the next few decades, due to the thermal expansion of the water in the oceans and to the melting of glaciers and of the polar ice caps. This rise in sea level may have *notable consequences for Spanish coastal tourist resorts*, because:

- It may threaten their existence or *present location*. In particular, the low coastal zones of the Mediterranean Coast and the Gulf of Cadiz may be affected.
- With an increase in erosion processes, all the coastal frontline *infrastructures* may be altered (beaches, seaside boulevards, docks, piers, marinas, among others).
- There may be adverse effects for the *freshwater reserves* available in the coastal wetlands and aquifers due to the intrusion of salt water, exacerbating a situation which is already critical, due to the water supply problems in certain tourist resorts.

In short, the impacts on the geographic-tourism space will not be homogenous and their effects will be worse in the more degraded areas, with big imbalances and a greater conjunction of climatic effects.

### 14.3.3. Repercussion for tourism demand

The sensitivity of tourism to climatic conditions can be seen in *two different ways* from the point of view of demand:

- *Directly*, because climate is a factor of primary motivation for mass leisure tourism, especially in the two main elements of the decision-taking processes in relation to vacations: destination and time of year.
- *Indirectly*, because climatic conditions are part of the environmental context of tourism. Thus, any alteration of the natural environment constituting the basis of the tourist attraction will affect the activities it sustains, such as the conditions of the beaches and coasts, the mountains, the natural and urban areas.

From the point of view of demand, the influx of tourism into Spain, as we have already pointed out (see section 14.1.2), comes from abroad and from within the country, and the repercussions of climate change in tourism can also be seen in a differential way.

*International inbound flows* come mainly from the countries of Northern Europe, basically Britain and Germany, which jointly total 49.6% of foreign tourists coming to Spain. The basic motivation of these tourists is to find warmer climatic conditions than in their own countries. This motivation is through comparison, and they seek higher temperatures and less rain and adverse conditions in order to do outdoor activities that they do not usually enjoy in their own countries (Perry 2001). Besides, Spain is a friendly country, safe and easily accessible, where, for example, it is not necessary to be vaccinated against exotic or tropical diseases.

If these comparable climatic conditions change, without any corrective measures being taken, several *effects on the demand for international tourism* can occur, if we consider that the tendencies contemplated involve the transformations of the tourism space mentioned in the previous section:

- *Decrease in summer holiday travel* to zones of the Spanish Mediterranean coast due to the loss of attractiveness of certain coastal tourist destinations, due to excessive temperatures in the summer season.
- *Increased travel in the country of origin*, because the tourists from Northern Europe will find within their own geographic area warmer conditions, encouraging them to holiday in their own countries.
- *Increased travel in spring and autumn* to destinations in Eastern and Southern Spain, reducing the strong seasonal influence seen in the summer months, because with the more moderate inter-season temperatures the coastal areas would be more attractive for this type of travel.
- *Increased travel by foreigners to the coasts of Northern Spain* due to the fact that the climatic conditions of these destinations would make them more attractive for tourists.
- *Increases in the length of the visit of certain segments* such as the elderly, who have more available time and who are becoming the majority tourists in certain destination due to the progressive ageing of the population of Europe. These can lengthen their stay in the coastal destinations, and even buy holiday homes in these tourist areas and come to stay permanently.

The *national tourism demand* has certain characteristics which are somewhat different from those of the foreign tourist. Those referring to motivation, seasonality and geographic concentration in Mediterranean coastal destinations follow similar criteria to the rest of the European countries, although less intensely. Thus, the diversification of the national demand leads Spaniards to visit inland destinations with a greater natural or cultural attraction, compared to the type of travel preferred by foreigners. Furthermore, we must consider that over

90% of trips made by Spanish tourists are made within their own country, and that changes in *climatic conditions are better accepted by the national tourist in his own country*, except for those owing to natural catastrophes or extreme events (flooding, forest fires), which have an almost immediate effect on demand. Besides, the big amount of second residences provoke other types of relationships with the social and natural environment.

Consequently, the possible repercussions for national internal demand are the following:

- *Progressive fragmentation of travel*, with a reduction of the number of days of the average stay in the destinations, due to the high summer temperatures associated with the sun and sand type trip.
- *Increased flows of tourists to the northern coasts* which could experience an improvement in climatic conditions (higher temperatures and less rainy days), which would favour bathing and outdoor activities, although the conditions of the sea, with regard to use, are different, due to their inherent characteristics (waves, wind, currents).
- *More travel to inland areas* with other attractions associated with nature, the rural world and culture.
- *Less travel to the nature areas* due to deterioration by climate impacts.
- *Shortened snow tourism season* due to less snow cover especially at lower altitudes.
- *Increased travel to Northern European countries* which would gain in attractiveness in summer months, with a softening of temperatures in these areas and notable temperature increases at home.

Although the effects on demand have only been considered in physical terms, the consequences for monetary variables (revenue, expenditure) would be in consonance with those described for travel. Thus, areas where wellbeing is less perceived would attract tourists with less purchasing power.

It must be remembered that tourism is a human and discretionary activity (Parry 2000) and the tourist expects to find favourable conditions that will provide him with a sense of wellbeing and a satisfactory experience. For both national and international tourism, therefore, the demand that is most affected is that associated with leisure and holiday tourism (the majority one in our country), whereas other types of tourist, like for work, visits to family and friends, health, studies or sports, would be less influenced by climate and its possible changes.

An important aspect of possible change in the behaviour of demand is the degree of *influence of weather forecasts* transmitted through the mass media. This information usually has a direct and immediate effect on decision-taking by tourists and is often generalist with little local accuracy, to the detriment of determined tourist destinations and seasons when the forecasts are not very favourable.

#### **14.3.4. Repercussions for the tourism demand**

The third level of climate change impact on tourism, after geographic space and demand, comprises the components of the tourism offer, mainly the tour operators.

Changes in demand flows are usually due to transformations in the preferences and desires seen mainly in differentiated types of behaviour. These will also involve modifications in the providers of services in a direct way, like *accommodation establishments and travel agencies*. However, we must point out the strength of the tourism industry, the future tendency of which will foreseeably be towards growth, because the main structural elements of its evolution, revenue and leisure time, can continue to develop favourably.



Tourism is an activity with great capacity to *resist crises* and with much *capacity to redistribute*. This means that the flows of tourists from one place to another could still continue to generate average profit levels similar to those obtained to date. The most negative and direct impact could affect the companies situated in the most vulnerable destinations, with serious economic consequences, mainly for those who depend on big investments in infrastructures. But, at the same time, the tendencies considered in relation demand allow these companies to extend their activities to other time periods, thanks to the lengthening of the season to the spring and summer months.

Other companies, like the *tour operators and travel agencies at the point of origin* would hardly suffer these impacts in economic terms, because their capacity to adapt is much greater and changes in demand would enable them to make other changes in destinations and other periods of higher intensity and better financial conditions.

The main repercussion at the global level of the offer and, consequently, for the Spanish economy as a whole, is the smaller amount of foreign tourists coming in, because they prefer to stay at home, which would lead to *lower revenue from tourism* at global level and in the more vulnerable zones, a risk for the stability of their local economies. However small or slow the changes may be, their effects in areas which are already suffering from serious imbalances could lead in the medium and long term to big changes in their economic situations and, in the worst scenarios, the progressive closure of their tourism and non-tourism establishments, increased unemployment and bankruptcy in the destinations.

#### 14.3.5. Changes in action by the system's agents

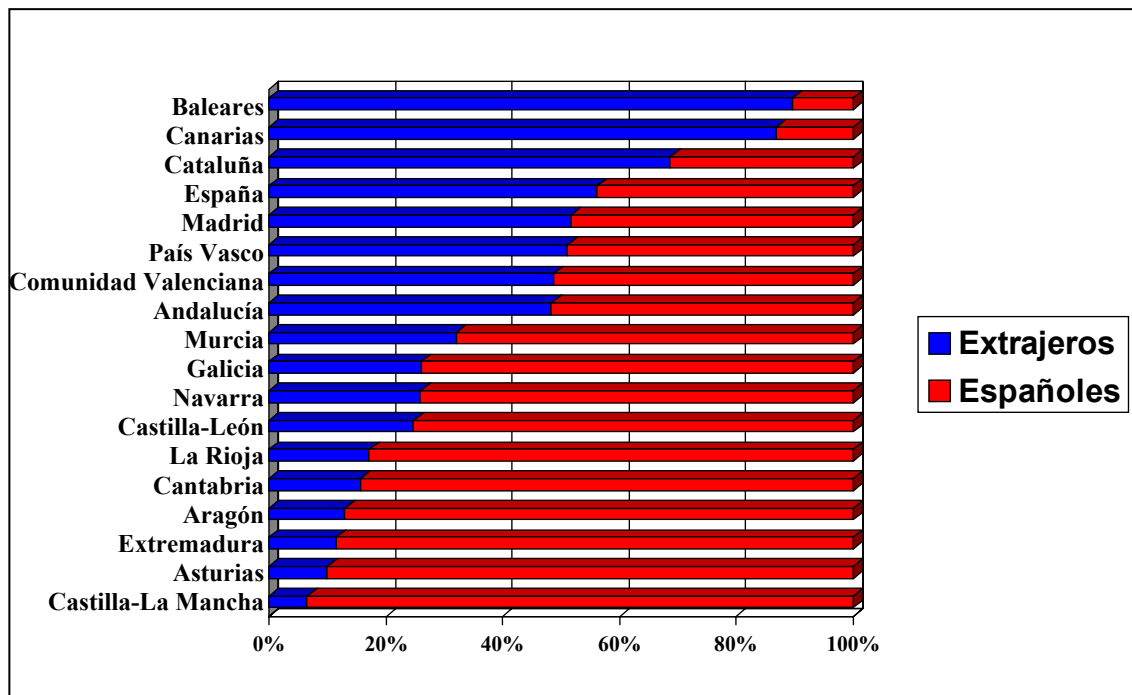
Tourism is a system in a continuous state of adaptation, responding to demographic change and to new demands and technologies. Climate change may present new challenges and opportunities for investment in tourism, allowing the new environmental conditions to be capitalised (Parry 2000). In this sense, the *public and private agents* acting in the system, mainly in traditional tourist destinations, can orient their actions in different directions:

- *Incorporating travel incentives* into their zones, with more tourist attractions combined with cultural and sports activities.
- *Maintaining the value of the lure of the coastal areas*, displacing future tourist complexes inland, although nearby.
- *Promoting less rigid infrastructures* favouring the expansion of the coastal areas and their long-term sustainability.
- *Improving the conditions of wellbeing* during the tourists' stay, installing air conditioning in all accommodation.
- *Designing Innovative development conditions* for the existing tourism offer with new products or modifying the existing ones.

The changes would have more influence in those areas most economically dependent on tourism, and, according to the aforementioned tendencies of demand and offer, they could have more affect in the regions most subordinated to demand flows from abroad (see Figure 14.4). By way of an example, around 34% of package tours abroad for inhabitants of the United Kingdom are to Spain, mainly to the Balearic and Canary Isles (Viner and Agnew 1999). The economic level or institutional resources of a community or region condition its capacity to adapt.

The agents can opt to make functional changes in the destinations in order to balance human activity and environmental conditions. However, the consequences of climate change can also lead to a change in the *interests of the agents* towards activities that take advantage of the new opportunities offered by the new scenarios, like the enlargement towards inland areas, in order

to progressively relieve the pressure in the more vulnerable areas, which also tend to be the most saturated and fragile ones, and whose future sustainability was already threatened, without considering the effects of climate change (for instance, rural tourism nearby the coast).



**Fig. 14.4.** Distribution of tourists according to regional autonomies (%) – 2003 (blue: foreigners; red: spanish) Source: Own design based on data from the Instituto de Estudios Turísticos (Tourism Studies Institute).

The *strategies* that the agents in the tourism system could develop will depend on the objectives set, which can be very different according to zones, the level of repercussion, the intensity of the changes in demand and the social and economic conditions of the destinations. The increasingly generalised tendency towards sustainability involves accepting slower growth rates, compensating for this by higher quality facilities and services provided, and the progressive disassociation of the destination from the exclusive sun and sand image.

## 14.4. MOST VULNERABLE AREAS

### 14.4.1. Zoning of tourism in Spain and vulnerability

In Spain, the impact of climatic change could affect in an unequal manner the different types of tourism and the different geo-tourism zones. Our country has a great diversity of resources, products and tourist destinations, which in turn present a very contrasted degree of relationship or association with climate in each case. In view of the preliminary nature of this report, the scale of analysis we are operating at and the objective –the identification of most vulnerable zones–, we have detected as the most vulnerable zones and products, those associated with the coastal and mountain environments. Specifically, it is *sun and sand tourism*, which has shaped the tourism function on much of the Spanish coast, and *snow-based tourism* (ski and mountain resorts) that has become the most emblematic type of tourism in mountain areas, and, in certain cases, the most important one.

The fact that the coast and the mountains are the tourist resorts most vulnerable to the impact of climate change is not a reality particular to Spain, and worldwide, it has been detected that sun and sand tourism and snow tourism might be the most affected by the predicted scenario of climate change. Indeed, the World Tourism Organisation, when it organised the *1st International on Climate Change and Tourism* (Djerba, Túnez, 9-11 of April, 2003), focussed the theme and the debates on the effects of climate change in three territorial environments: the coastal areas and islands, mountain regions and the areas exposed to drought or flooding.

#### 14.4.2. Coastal areas and products

The geographic condition of the *coastal space* (maritime dynamics and coastal morphology), the model of territorial organisation and, in particular, the model of tourism development, are the factors determining the greater or lesser degree of the predicted climate change. In a country whose activities are increasingly more involved with the seaside, as opposed to former times, the *natural vulnerability of the coast is increasing as a result of the high degree of artificialisation*. Furthermore, given the diversity of the Spanish coast, and its unequal tourism potential and development, fundamentally sun and sand tourism, the premise is that the impact of climatic change will be different in each coastal zone.

In relation to *regional contrasts*, the description of the coastal areas in Spain distinguishes the Mediterranean and island coasts from the Atlantic and Cantabrian (northern) coasts. Spain has beaches of all types and conditions and very varied climates and waters. Over 80% of international tourists visiting Spain goes to its beaches: Mediterranean, North Atlantic, South Atlantic and the Canary Isles (with a subtropical climate). Depending on their climates, attributes and the time of year –clearly related to climatic cause-effect- Spanish beaches present a higher or lower level of adequacy for tourism. Taking the season of the year as a reference, it could be said that there are beaches that are used throughout the whole year. These are the ones on the southern Mediterranean coast and on the Canary Isles. The summer beaches, and, to a great extent, the spring and autumn ones, are on the northern Mediterranean coast and the Balearic Isles. And, lastly, the summer beaches are those of *Green Spain*, that is to say, Galicia, Asturias, Cantabria and the Basque Country. In the scenario of climate change, the impact will undoubtedly be different and following a variation in climatic conditions, the “right time of year” for the beaches, in relation to comfort, will also be modified, which will give rise to new positive or negative situations and, in any case, to the *need for adaptational strategies*.

The *northern and central Mediterranean* encompasses the coasts of Catalonia, Valencia and Murcia. Three sectors are distinguished, shaped by concave arches, the result of the settling of the coast. The first sector, between Cabo de Gata and Cabo de Palos in Murcia, present a morphology with a predominance of rocky, broken coastline. The second sector, between Palos and Cabo de la Nao, in Alicante, corresponds to a very varied coastline, from low and sandy to high and abrupt. Finally, the third sector, from Cabo de La Nao to cabo de Creus in Girona, presents an alternation from high and rocky to low, sandy coastline.

*The coastline of Andalusia* stretches along the southern Mediterranean and the southern Atlantic, and two sectors can be distinguished here: the first, between Punta de Tarifa and Cabo de Gata, is characterised by being generally rocky and with cliffs, although some low sectors open onto sandy beaches; the second, from Tarifa to the mouth of the river Guadiana, is a low, mostly sandy coastline. With regard to the archipelagos, both the Balearic and the Canary Isles present very variable coastlines, climate being the differential factor of the environmental conditions in these tourist destinations.

The *North Atlantic and the Cantabrian* coasts offer a diversity of tourist activities and in this region, sun and sand tourism is generally not hegemonic, and in spite of being mostly based on sun and sand, it is still very far from the typical model of Mediterranean tourism. The Cantabrian

coast is a straight line with very few recesses or projections and a rough sea. There are very few beaches, although the ones that do exist are very attractive and with fine sand, the result of the action of the Cantabrian sea. Thus, high and rocky coastline predominates, mainly due to the proximity of the Cordillera Cantábrica mountains. The coasts of Galicia present a different physical space: a high, abrupt coastline with successive cliffs and with geographically particular areas. A unique landscape of great value for tourism, made up of creeks that vertebrate this extraordinary coast, with long inlets that break up the cliff coastline and allow for the establishment of population nuclei, protected from the permanent fury of the ocean.

In short, *very varied morphology and coastal dynamics*, which will be *affected in different ways* by the foreseeable climate change, whether by the alteration of climatic conditions or by a rise in sea level and marine dynamics. In this case, the Mediterranean Coast and Gulf of Cadiz sectors would be affected.

The effects of the foreseeable climate change on coastal tourism could cause a *displacement of seasons* due to the intensification of the hot and dry summer period, but, on the other hand, the favourable effect of enlargement and *deseasonalisation* of this period is predicted. Consequently, the holiday period may be lengthened. There may also be a greater frequency of atypical periods, due to excessive heat out of season and, although it may seem contradictory, sporadic fresh and changeable summers. The summers will get hotter to the point that the sun will become an uncomfortable factor, and being too hot, Spain may lose its lure and its comparative advantage with other destinations. Very hot weather is predicted for southern Europe, perhaps too hot to go on holiday, but this condition is also predicted for Spain's competing destinations. Consequently, the long-term forecast is that the countries in the Mediterranean basin, -including Spain- will become tourist destinations mainly for spring and autumn.

An appraisal of this foreseeable scenario, however, allows us to reject the alarmism and the catastrophic bases of certain hypotheses. A temperature increase would not have serious consequences for Spain, because the change in climatic conditions on the coast could have a *deseasonalisation effect*, as we have already pointed out, as it is possible and predictable that the tourist will enjoy bathing in the sea from May to October. It is also possible that mass tourism will decrease in the months of July and August, not only due to the increase in temperatures, but also because people are tending to distribute their holidays throughout different periods, which has nothing at all to do with climatic change.

The change in climatic conditions, in the direction predicted, could also involve *new opportunities for the development of sun and sand tourism*, with new demand segments. This might involve seeking and developing destinations with pleasant summer temperatures, like, for instance, Northern Spain (Cantabrian coast) and the mountain areas. Other opportunities will also arise for others scopes of business related to tourism, such as an increase in visits to protected natural spaces, or through the revaluation of the destinations dedicated to nautical or inland sports and activities on the rivers.

*Activities related to tourism depend directly on the quality and availability of the resources used*, whether these be renewable or not, as well as factors related to offer, infrastructure and services, among other. This is why environmental degradation is directly associated to the loss of attractiveness, and therefore, to the cessation of the tourism activity, due to the impossibility of continuing under these circumstances. In the case of the foreseeable climate change, the Spanish coastal destinations would be affected by the change in environmental conditions and, as a result of this, adaptational strategies would need to be planned. Society would have to deal with the physical deterioration of the coast, investing in works to protect, renovate or rebuild the seafront, or opt to rationalise the human occupation of the coastal areas.

The change in scenario does not only involve an alteration of the conditions of resources for tourism, but also a modification of the availability of, and competition for, the *inputs* into the

tourism system and, in particular, *the water supply*. This problem already exists in certain areas due to the concentration of the tourism demand in time and space. In order to satisfy the demands, the system will have to resort to the desalinisation of sea water, the use of subterranean resources (which in many cases has led to the overexploitation and salinisation of coastal aquifers, which is practically irreversible), and the construction of new dams or water transfer systems. The solution to the water problem is clearly one of the key factors for the maintenance of much of the tourism industry on Spanish coasts, particularly in the possible scenario of climate change.

The theme of climate change and its impact on the tourism sector is happening at a time in which tourism is undergoing certain changes in supply and demand at a rate unknown to date, to the extent that some analysts consider it to be a *change in the tourism paradigm*. This reference is of interest because the alterations experienced by tourism in the future could be caused by the impact of climate change and if this occurs, they will be projected onto the modification that are already underway, onto the new tendencies of supply and demand: the change in destinations, the appearance of other competitive destinations, traditional sun and sand ones, others far away and others of a different type competing with sun and sand (urban, nature, culture, among others). To a certain extent, the theme related to the foreseeable loss of attractiveness by Spanish destinations must also be dealt with in comparative terms, that is, it must be understood that climatic change will also affect other destinations, both from the same business segment (sun and sand, destinations both nearby and far away) and of other products.

By way of a conclusion to the analysis of this foreseeable situation, it is vital that we implement *converging strategies* in order to provide adaptational actions both at national level and at particular destinations, according to their state of evolution and their existing degree of deterioration, as it is not the same acting in unsaturated geographical parts of the coast as in areas which currently suffer from serious imbalances.

#### 14.4.3. Mountain zones and products

In winter tourism (snow tourism – ski resorts), the consequences of climate change are now more evident than in the case of sun and sand tourism, and the difficulty involved in adapting it is also more patent. Thus, it is generally agreed that the mountain areas affected can be seen to be more vulnerable than the coasts and the islands.

Knowledge of the *snow layer and its annual renovation*, as well as of the potentially skiable domains, is quite accurate at the present time, even from the point of view of the conditions it offers related to commercial exploitation and economic viability. The different mountain massifs present a *high level of diversity*, both in comparative terms and with regard to their own internal composition, and this diversity depends, in each case, on the respective northern or southern latitudinal location and on altitude, parameters which will determine their environmental conditions in general, and in particular, the snowfall regime, with the resulting availability or non-availability of the snow resource. For example, in the Pyrenees, a great deal of the precipitation in the winter months consists of snow and there are many places and zones that register between 20 and 30 days of snow a year, with notable thicknesses and a permanence of several months. Snowfalls becomes significant in many parts of the Catalonian Pyrenees above the elevation of 1,500 m. But above 1,800 m, the snow layers, which over 15 cm. Between December and April, are more interesting and favourable from the commercial point of view (López Palomeque 1997).

The snowfall regime is characterised by *temporal* (seasonal and inter-annual) and *spatial* (altitudinal and latitudinal grading of Spanish mountains) *irregularity* which in turn causes irregularity in the snow business. This regime gives rise to cyclical situations encompassing very bad periods with hardly any snow to others with abundant snow, thanks to generous meteorology. Wind, fog and high temperatures have a negative effect on the permanence of the snow. Besides,

we have to take into account the commercial structure of the resort and the capacity of its technical services, a basic factor for the maintenance of the snow layer (machines, signposting).

The irregularity of the snow has led to the adoption of strategies for the production of this natural resource through *the manufacture of snow* (produced snow), the installation of “snow cannons”, which has been habitual practice in all resorts since in 1985 La Molina (Girona) installed the first cannons. In the 2002/2003 season, there were 3,319 cannons. In short, the resorts have been forced to install snow cannons in order to guarantee the practice of skiing, by overcoming climatological conditions. Furthermore, given the need for all of this, and the costs and pressure of the investments made, the public administration has lent a hand to the sector with different lines of grants (snow insurance, investments in snow cannons, promotion, machinery) (Gómez Martín and López Palomeque 2003).

Spain has 29 *alpine ski resorts*, 13 of which, in turn, have ski runs for cross-country skiing, and 15 resorts exclusively for cross-country skiing. Spanish ski resorts have a total of 344 mechanical lifts, with 7 cable cars, 136 chair lifts and 201 teleskis, with a transport capacity for 356,671 people/hour. These 29 alpine ski offer a total of 822 ski runs totalling 864 linear skiable kilometres and *Half-Pipe* and *Snowpark* km. for the practice of snowboard. With regard to cross-country ski, a total of almost 400 km. of ski runs was on offer for the 2002/2003 season. Practically all of the most important Spanish mountain ranges have ski resorts: *the Macizo Galaico* massif (Manzaneda resort); the Cordillera Cantábrica (Alto Campoo, Valgrande-Pajares, San Isidro, Leitariegos); the *Sistema Ibérico* range (Valdezcaray, Valdelinares, Javalambre); Aragón Pyrenees (Astún, Candanchú, Formigal, Panticosa-Los Lagos, Cerler); Catalanian Pyrenees (Baqueira Beret, Boí Taüll, La Tuca, Espot Esquí, Tavascan, Llessui, Port Ainé, Port del Comte, Rasos de Peguera, La Molina, Masella, Vall de Núria, Vallter 2000); the *Sistema Central* range (Navacerrada, Valcotos, Valdesquí, La Pinilla, La Covatilla) and the *Sistema Penibético* range (Sierra Nevada). The maximum elevations of the resorts are at around 2,500 metres and the minimum elevations at around 1,500-1,800 metres, with the exception of Sierra Nevada (2.550-3.280 m.), the southernmost one.

In spite of the irregularity and the limitation of the snow and of the vulnerability of the snow business, the mountain and snow sector in Spain has been growing in the last few years in relation to its two basic components: demand and supply. Winter tourism in Spain, however, presents certain structural contradictions which generate malfunctions that will be exacerbated by the impact of climate change, although these will vary according to the mountain range: irregularity of the snow resource and insecurity in the snow business, dependence on the environment, automated production of snow within a context of difficult ecological balance, under the auspices of the public administration.

There are two types of evidence of the impact of climate change on winter tourism. On one hand, *the scientific evidence*, the different studies showing the slight increase in mountain temperatures, the lower average thickness of the snow and the greater temporal and territorial irregularity of snowfall. In Spanish mountains, there is a tendency to decline of precipitation in the form of snow and a tendency of temperatures to rise (particularly in February and March). An observable effect supporting these new parameters is the reduction of the Pyrenees glaciers – half of them have melted since half-way through the eighties- and the increased elevations of the snow layer. If these tendencies continue, there will be increasingly less snow at lower elevations. Furthermore, *the empirical evidence* backs the scientific knowledge. This involves the perception of change by veteran skiers who state that the snow elevation has risen, that there is now less snow at lower altitudes. Certain businessmen and resort managers also share this opinion, to the extent that they have made big investments in the production of artificial snow the long-term profitability of which is uncertain, and this is one of the biggest worries in the sector.

The predicted climate change will not mean the end of skiing, because the resorts at higher

altitudes can survive as *winter tourism resorts*, whereas reduced snowfall will have serious economic consequences in the valleys that earn their living from skiing and a big ecological impact in the high mountain. It is predicted that, as the ski resorts start having problems at lower elevations, and as they abandon the skiing offer, the pressure will increase in ecologically more sensitive high-mountain areas. The viability of the resorts at lower altitudes will initially depend on the artificial snow cannons. But in the long term, the temperature increase will make the production of snow increasingly inefficient and costly (Scott *et al.* 2001).

The *adaptation strategies* for adjustment to the impact of climate change contemplate the intensification of the artificial snow, which is very well developed and which has a fragile ecological balance due to the fact that it has been a strategy for the last two decades for dealing with the temporal and spatial irregularity of snowfall. This strategy could benefit from technological advances (high-tech cannons that make the manufacture of snow possible at higher temperatures, about 2 degrees higher than before), but the intensification of this system clashes with the principle of economic sustainability and environmental sustainability.

However, this strategy would only solve the problem partially, and therefore, the ski resorts *would tend to become mountain resorts* (with diverse products), losing the specific nature of the original, exclusive product; the snow. This could be maintained to a lesser degree, at higher elevations, through artificial production, but it would be very costly, and at odds with the principle of environmental sustainability. The ski resorts would be transformed, ceasing to be purely winter resorts, becoming instead “tourist resorts” –on occasions in the classical sense of the term *resort*- with a variety of products on offer throughout the year, particularly in summer, with demand from tourists who dislike the beach destinations. The *deseasonalisation* of the activities of these centres is now a reality and will continue to be so in the future. This process would involve, on one hand, a strategy for optimising the facilities and the business management itself, widening the range of products with new business opportunities, and within the framework of this Report, an adaptational process imposed by the impact of climatic change.

Considering this forecast, *two needs* are imposed:

- The *planning of the development projects* and of initiatives for new resorts, avoiding the construction of infrastructures which in the medium term could become obsolete as a result of climate change.
- The need to *manage in a responsible way* the remaining resources (landscape, monument heritage), increasing the value of these as tourism resources, as they were only of a complementary or secondary nature until now, related to winter tourism, but in the future, these resources may become an alternative, replacing the snow as the main attraction of the ski resorts, reconverted into mountain resorts.

#### 14.5. MAIN ADAPTATIONAL OPTIONS

As can be seen in the previous epigraphs, Spain, is a leader in tourism, occupying first place with regard to sun and sand tourism, and if climate change affects tourism, especially the sun and sand modality, our country will foreseeably be affected by this phenomenon, with serious consequences.

*Sun and sand tourism in Spain* is a mature product, especially on the Mediterranean, and it will continue to be demanded, because enjoying a good climate close to the sea and fleeing from cold, unsettled weather is still one of the main motivators for tourists from Northern and Central. Consequently, the decisions taken by tourists as consumers of products, along with business decisions and strategies, may be subjected to certain modifications as a consequence of the sensitivity to the predicted climate changes. It is also likely that there will be a process of

readaptation of the tourism subsectors and of the ones depending on these, in which some lose importance, possibly in favour of others.

These changes will not only occur within the scope of sun and sand tourism, but also in *other products*, like ski tourism and even determined types of rural and nature tourism which could be subjected to extreme circumstances caused by climate changes of a tropical nature, infrequent to date in Mediterranean countries. As a result, changes in decision-taking strategies will go beyond what is referred to as sun and sand tourism.

#### 14.5.1. Adaptational options in relation to demand

One of the integrating elements of the tourism systems which will most suffer the impact of climate change is the demand for tourism. The first change that demand may show in its adaptational evolution towards the conditions of the natural environment are focussed on the *modification of behaviour by the tourists*, because their tastes, desires and needs will vary according to their appraisal of the destinations, their perception of the conditions in which the new products are offered or the existing ones are modified, and their expectations of having a satisfactory experience on their holiday. Some possible *adaptational reactions of demand* are:

- Climatic change may accelerate the tendency that has existed since the last decade of the last century towards a *reduction by the tourists of the average stay* in sun and sand destinations. In any case, at other times of the year the tourist might repeat visits to destinations of rural or urban tourism, among others. Since around one decade ago, we have been seeing the dangers of excessive sunbathing without protection. Although it is true that the sun and sand destinations based on a sunny environment and good weather are gaining ground over pure sunbathing, these health hazards, along with higher levels of insolation due to climate change may lead the tourists to reduce the duration of their stay, reinforcing the aforementioned tendency, initiated years ago, for other different reasons.
- Another aspect refers to the likely change that will occur at the *moment of decision-taking*. Good climate is a basic characteristic of the sun and sand destinations and an important one for people travelling to the Mediterranean for other reasons. The tourist needs a certain guarantee of good climate. In turn, climate change will lead to an increase in drastic changes in the weather which may even bring us closer to tropical climates, fundamentally in summer. This would lead to increased uncertainty regarding the climatic conditions for the holiday the tourist is trying to plan. This is why the most likely course of action for the tourist would be to take the decision about travelling and purchasing the services at a date much closer to his trip, in order to be able to cancel it without any additional cost, and with more guarantee of sunny, settled weather. Here we would see the reinforcement of a tendency started a few years ago, consisting of waiting till the last week to buy the package tour or the transport ticket and to book accommodation. The development of electronic booking and purchase facilitate this adaptational option
- If we consider the Third Evaluation Report by the IPCC in the year 2001, which states that Mediterranean Southern Europe is the region most endangered by climate change, seen in successive droughts and flooding, and, to the contrary, in Northern Europe there could be benefits for agriculture and regarding the influx of tourists, we can deduce that this greater vulnerability may mean that tourists from Central and Northern Europe may choose to stay at home and to do *domestic tourism* or perhaps travel to other countries in the same geographic area. Thus, there exists the possibility that there will be a lower number of tourists travelling to Spain due to the generalised reluctance of these countries as a result of the uncertainty generated by extreme climate changes or the lack of resources like water.



### 14.5.2. Adaptational options in the demand

Under these circumstances, there is sufficient reason to believe that the tour operators selling the related goods and services will have to modify determined aspects of their business in the planning of their strategies in the different fields of management. Phenomena of climatic change and its consequences will generate *higher levels of uncertainty* than the ones considered normal in the related business activity. The consequences of this could be:

- In the *first place*, in the financial calculation of new investments in tourism, the elements of uncertainty due to climate change will have to be incorporated, and these, in turn, will lead to higher levels of risk, and therefore, the *diversion of likely investments towards other sectors* of the economy, in those activities with alternatives, or in the opposite case, a progressive withdrawal of investments.
- In the *second place*, and as a consequence of the previous point, the tour operators will have to establish *strategies to protect themselves to the maximum from these situations of uncertainty*. The high level of seasonality in sun and sand tourism in most areas of Spain, as well as in other types of tourism, like ski resorts, means that determined climate changes affecting the periods of highest demand will give rise to a decrease in financial results. In both cases, the tourist season will suffer alterations with regard to duration and intensity. Thus, the entrepreneur will have to be prepared to deal with financial results less positive than the usual ones in a determined year. As will be seen subsequently, this could lead to the creation of insurance instruments to guarantee the indemnification of these likely results.
- In the *third place*, with regard to short term decisions, the insecurity caused by sudden changes in the weather resulting from climatic change will alter the timing of bookings of travel by the tourist, with an *increase in last-minute bookings* aimed at guaranteeing to a greater extent better and more stable weather conditions. Consequently, the taking of business decisions may suffer big delays in order to better adjust the supply to the demand. The most obvious example, although it is not the only one, has to do with decisions related to prices in the supply-demand adjustment process, as occurs with the typical last-minute offers. For this reason, company management requires higher levels of flexibility, especially in the financial aspect, in order to adjust more rapidly to sudden variations in demand. It is true that the intense development of new technologies will be of great help in this respect, although in aspects like labour or the administration of stocks, changes will be needed.
- Finally, in *fourth place*, companies will have to establish strategies to protect themselves to the maximum from the effects of extreme climate change. For instance, in the construction of buildings, for accommodation or for complementary offer, work will have to be done to protect them from damage or from conditions related to the tourists' wellbeing caused by the aforementioned effects, in order to *guarantee the customers' comfort and safety*.

## 14.6. REPERCUSSIONS IN OTHER SECTORS OR AREAS

### 14.6.1. Territorial conflicts over resources

In all countries in which there is a notable variation in climate among the different regions, like in Spain, there are logical substantial differences in the provision of determined natural and energy resources, the use and enjoyment of which is indispensable for tourism as a recreational activity and to satisfy the personal needs of the hundreds of thousands of tourists constituting the real population in a determined region within a specific period of time. This reality gives rise to *two basic questions*:

- In the first place, big problems will arise at the time of allocating these *natural resources* which can be shared by areas and regions. A very clear example is water, because during these climatic processes involving long periods of drought, the existing territorial conflicts will be exacerbated with regard to the supply of zones with a traditional deficit by the zones that have a surplus of the resource in question.
- With regard to *financial resources* mainly from the public sector, some regions could suffer certain consequences of climate change, like a reduction of the sandy beach areas due to a rise in sea level, and this will require engineering infrastructures to protect these areas as much as possible, as well as certain risks in some regions that might be due to catastrophic situations which would require the joint use of large amounts of extraordinary resources. In short, it is very likely that climatic change will necessarily lead to a significant redistribution of public financial resources among the Regional Autonomies in order to deal with these situations, and this could also lead to conflicts between territories.

#### 14.6.2. Transversal repercussions in the economy of the tourist destinations

It seems obvious to think that if climatic change affects the management and results of the tour operators, these consequences will be generalised to *many of the sectors related to tourism* and, in short, the series of economies based on tourism.

In this sense, the *agricultural and industrial sectors* supplying hostelry and restaurant products, above all perishable goods, will have to manage their stock in a more flexible manner in order to adjust to the unforeseeable changes made by their buyers. The consequences of possible change in climate will depend on their duration and intensity.

With regard to *services* it must be pointed out that now more than ever, the companies and tour operators in particular are resorting to the so-called “*outsourcing*” or sub-contracting of work. Logically, these services that are required on specific occasions will be affected to a certain extent by a possible season of lower profits due to a climatological phenomenon. On the other hand, the services that are provided in a continuous manner poor results and which are linked to daily demand will also have to adopt management strategies governed by decisions taken in the very short term.

#### 14.6.3. Repercussion in specific sectors

Considering this sectorial panorama and, specifically, the type of repercussions to be expected from climate change, we must highlight the important role to be played by the financial sector, and in particular, the *insurance sector*. The financial sector will have to make the changes necessary to adjust its activities to the needs of loan funds for unforeseeable events. The insurance sector will undergo multiple changes:

- As the decision to travel will be delayed until just before the leaving, the desire of the tourist to guarantee the trip, weather permitting, will lead to the better development of the *cancellation insurance* for specific circumstances. In this case, not only is the growth of this type of insurance considered, but also an increase of the cover it provides beyond the traditional cover based on problems like health. This new system is very complex, because it depends on indicators and forecasts of climatic instability which are at present non-existent.
- The possibility also exists of insurance typologies that enable the tourist to *claim against determined climatic conditions* once his journey has started. In this case, consideration could be given to the possibility of insurance, from determined insolation levels, based on the

normal temperature conditions in the destination visited, to the chance of recovering part of the money spent if certain extreme climatological conditions occur.

- The establishment of *new forms of insurance* will also be used by companies with regard to situations of uncertainty and instability of tourism resulting from climate change. An insurance could be created to cover the possibility of extreme climatological situations, in relation both to its effects and its duration, and this would clearly affect the evolution of the tourism business. It would be an insurance typology parallel to agricultural insurance, which would have to clearly establish the precise climatic conditioning factors obliging the insurance companies to compensate. This insurance might become indispensable in order to provide the guarantees demanded by banks when setting the terms of any type of loan, both for financial investments and for discount operations.

One of the most particularly affected sectors could be the *energy sector* mainly due to increases in energy consumption for the fitting out of tourist establishments (accommodation and restaurants), considering the private demand by the tourists themselves for pleasant temperature conditions in the facilities. The level of energy consumption, as well as other resources like water, is directly proportional to climatic variations in temperature. Even solutions to other problems, like the water supply for coastal areas using desalinisation or purification, or the production of artificial snow in mountain destinations, cause an increase in energy consumption. In Spain, we still have to initiate studied into the development of tourist infrastructures that make use of other sources of energy, alternatives to the traditional ones, or ones that save energy in the use of the existing systems.

Another particularly significant sector is *transport*. According to the IPCC (2001), aviation represents 3.5% of greenhouse gasses, and within a few decades the current growth rate could reach 11%. However, as the objective of this study is to evaluate the effects of climate change on tourism, it must be said that different environmental organisations and institutions recommend that the use of trains or busses for closer destinations be encouraged, and the use of the plane be discouraged, as this type of tourist transport uses a lot of energy. For instance, the daily energy consumption (estimated by the Oficina Federal de Medio Ambiente, the federal environment office, UBA) for a trip from Germany with a stay of 15 days, for the Balearic Isles, is: 317 MJ; Canaries: 732 MJ, Río de Janeiro: 2,101 MJ and México: 2,096 MJ (considering that 100 MJ = 28 KWH).

It is easy to see that any long-distance journey would be seriously affected by any legal restrictions. In the case of Spain, the tourist zones for which the aeroplane is practically indispensable -Canary and Balearic Isles- would be relatively affected in comparison to the rest of Spain, especially if we consider that only a daily consumption of less than 200 MJ is sustainable.

Logically, all the systems of regulations and/or systems of incentives for transport aimed at stopping the pollution process will have big differential impacts on the different transport systems, depending on the technology used.

#### **14.7. MAIN UNCERTAINTIES AND KNOWLEDGE GAPS**

In the analysis of the influence and repercussions of the impact of climate change on tourism *there are more uncertainties than certainties*, because there is no information, or at least no reliable data dealing with the possible effects of variations in meteorological conditions. There are many factors affecting global tendencies in tourism, and it is difficult to judge the proportions of this change on only one of these.

The observation of specific, occasional events indicates that tourism is always very vulnerable to natural disasters in the local environment and for a period of time that depends on the scale of the damage and the financial capacity to recover or repair.

From the *perspective of demand*, we are unaware of the possible variations in behaviour resulting from climate change and from the quantitative level of the impact this would cause. In specific terms, we can highlight the *following questions*:

- At what *temperature* does the comparative effect begin to stop northern European tourists from travelling to the coastal areas in southern and eastern Spain, favouring holidays at home?
- What are the possibilities of the tourists, both national and foreign, of *modifying their summer holidays* in order to change them to the autumn and spring seasons?
- Would the *destinations in northern Spain be attractive* if climate conditions were to be modified?
- What are the chances that tourists travelling to Spain will modify their *behaviour*, favouring destinations based more on culture, nature and the rural world, in spite of the predominant image of sun and sand?
- Under what conditions would the tourist lose the *feeling of comfort and safety* in the traditional tourists destinations?

From the *perspective of the agents* acting in the tourism system, the main uncertainties are the following:

- *Political and legal restrictions* for the allocation of resources, such as energy and water supply, in the most vulnerable tourist areas.
- *Capacity for adaptation and transformation* of the present tourism infrastructures and companies with regard to changes in the behaviour of demand.
- *Changes in the interests* of the local agents towards other sectors or economic activities.
- *Changes in uses* or in the degree of utilisation of the natural, cultural and social tourism resources.
- Repercussion in *transport* of restrictions within the international scope (Kyoto Protocol) or the national scope (National Allocations Plan) resulting from agreements on emissions of gasses.
- *Level of compromise* towards other forms of sustainable tourism development and financial capacity to implement them.

As there are no models for quantifying the interrelations between climate and tourism, and the responses to variations in demand, we are unaware of the upper and lower limits of the different climatic indicators that would modify the behaviour of the tourists and the agents in the tourism system.

## 14.8. DETECTION OF THE CHANGE

### 14.8.1. Indicators of habitual use according to the tourist zones and products

There are several methods for evaluating climatic potentiality from the tourism point of view. In this respect, a division is normally established between those that make use of *climate-tourism indexes* and those others that analyse *types of weather*:

- With regard to the *climate-tourism indexes*, it should be pointed out that tourism climatology has often based study of the climate-tourism potentiality of an area on formulae that combine, in a more or less accurate manner, different elements of the climate (Burnet 1963; Cerezuela and Ayala 1987, Davis 1968, Flocas 1975, Hughes 1967, Marchand 1986,

Mieczkowski 1985, Poulter 1962, Sarramea 1980). Most of these indices have many points in common, and sometimes they only vary in the number and nature of the parameters considered, or in the relative weight assigned to each of these. The utilisation of these indexes has certain *positive aspects*: in general they are relatively easy to calculate, they accentuate the interdependence of the different elements of climate and they provide one single figure that helps to understand a reality which is often complex and give results that are relatively easy to understand and to interpret. But they also present *less convincing aspects*:

- Most of the indices are calculated with data each one of which is expressed in *its own unit of measurement*, which makes them the object of criticism by many specialists who do not accept sums of magnitudes of a different nature to be mathematically combined.
  - The indexes involve *a considerable loss of information* and lead to a high degree of abstraction, fundamentally due to the scale used (monthly measurements and on occasions, three-monthly ones). The climate experienced by tourists cannot be related to the “theoretical” climate defined by the measurements: all the surveys show that the tourist only reacts according to real weather.
  - The indexes *rarely incorporate the preferences* shown by the tourists themselves in relation to the conditions they consider optimum for tourism.
- The method based on *weather types* (Barbière 1981, Besancenot, Mounier and de Lavenne 1978, Crowe, McKay and Baker 1977a, 1977b, 1977c) solves some of these problems by not using measurements and working directly with weather situations experienced on a day-to-day basis by the tourists. Furthermore, it allows for the incorporation of subjective aspects related to perception. The weather types method consists of making a classification of day-to-day situations which are more or less apt for the practice of tourism. These situations or weather types, which are based on several atmospheric parameters, are subjected to an analysis of frequencies within the framework of a determined regional unit.

However, the use of these indicators has never been applied to evaluate the impact of climate change and its effects on the tourism sector. Usually, variations in the *number of tourists* or in the *levels of occupation* of hotels can be used to learn of the possible existence of the consequences for demand of determined climatic conditions at the destination, unusual climatological differentials between the country of origin and the destination (Scott and McBoyle 2001). However, the climatic phenomenon could not be isolated in any case from the other factors that could also have contributed to the results of a specific season, or, to the contrary, that might have counteracted determined climatological factors.

In the future it will be necessary to *develop reliable forecasting systems* integrating climate changes resulting from alterations in ecosystems, with the socioeconomic factors, and in particular, those related to tourism, intervening in a determined area. Interdisciplinary efforts will obviously be indispensable in order to evaluate the extent to which the tourism indicators are or are not influenced by these meteorological phenomena, what degree of retardation can be applied to the effects of climatic conditions or what their long-term consequences will be.

#### **14.8.2. New indicators proposed according to tourism areas and products**

The new indicators enabling us to answer the questions posed can be *differentiated according to types of areas and products*, mainly coastal and mountain ones.

**Tabla 14.1.** *Tourism areas, products and indicators*

<b>COASTAL TOURISM AREAS AND PRODUCTS</b>	
<b>Indicators</b>	<b>Description</b>
Energy consumption	Energy consumption (electricity, gas-oil, etc.) is very sensitive to variation in atmospheric conditions. Detailed and diachronic analysis of this indicator at the tourist destinations could indicate climate change.
Water consumption	Increased water consumption at the tourist destinations could be a factor indicating climate change.
Investment in the regeneration of beaches and coastal infrastructures	An increase in extreme events and in sea level would cause damage on the coast which would need to be corrected in order to maintain the efficiency of tourism. The temporal perspective of investments could be considered as an indicators of climate change.
Investment in the installation of interior and exterior spaces	Temperature increases would favour the installation of indoor air conditioning systems, but would also favour the installation of awnings, canopies, fountains and trees outdoors. The temporal evolution of the investments made in this sense could be indicative of climate change.
Duration of stays according to months and seasonal distribution of tourists	Climate changes would cause modifications in the activity schedules: the visits (fewer in the middle summer months and more at the extremes and in the inter-season periods) could also demonstrate climate change.

<b>MOUNTAIN TOURISM AREAS AND PRODUCTS</b>	
<b>Indicator</b>	<b>Description</b>
Energy consumption	Energy consumption (electricity, gas-oil, etc.) is very sensitive to variation in atmospheric conditions. Detailed and diachronic analysis of this indicator at the tourist destinations could indicate climate change.
Water consumption	The increase in water consumption for the production of snow in the winter resorts could be an indicator of climate change.
Investment in production of snow	Increased investments in the production of snow and the laying of this could be indicative of climate change.
Duration in days of the winter season	Diachronic analysis of the duration in days of the winter seasons in the different ski resorts could provide information on climate change.
Lower limit of the skiable zones	The annual evolution of the lower limit of skiable zones could demonstrate the phenomenon of climate change.

#### 14.9. IMPLICATIONS FOR POLICIES

The First Conference on Climate Change and Tourism, organised by the World Tourism Organisation in the year 2003, reached the following conclusions related to *public policies* (WTO 2003):

- Introducing tax incentives or *financial aid* to cover the modification of the tourist infrastructures constructed, in order to deal with the consequences of climate change.
- Considering, wherever necessary, a modification of the tax *system* (for instance, new hotels in more vulnerable coastal areas could pay off their investments in shorter periods of time).
- Incorporating *tax incentives* to encourage the use of traditional building materials.
- Increasing *public investment in infrastructures* for the development of new tourism infrastructures in order to lessen the impact of climate change.
- Adopting, wherever necessary, *legislation* to modify planning policies, demarcation systems and priorities related to the use of the land.
- Introducing *changes in school schedules* to avoid excessive concentration during school holidays.
- Providing *training* to employees in the tourism sector aimed at dealing with the consequences of climate change, including practical assistance in decision-taking.
- Providing training to *recycle workers in the tourism sector* when significant market quotas have been lost.
- Reviewing the *financing policies of the tourism information offices* ensuring that promotion and marketing activities are adapted to the new climatic realities (for instance, promoting inter-seasonality).
- Reorienting *national transport policies*, agreeing, for example, to give less priority to aviation and more priority to national transport.

All these recommendations require the incorporation of *new principles for the public management of tourism*, with the necessary co-ordination among the different areas or sectors involved (economy and taxation, education, labour, environment, infrastructures) as well as among the spheres of responsibility (national, regional and local), with greater participation of the public administration in the management of tourism.

The main and most direct implications would be in regional and local policies. These policies must *revise the existing strategies* for the management of tourism related to occasional and specific increases in demand in certain coastal and rural areas (Parry 2000). Policies should be implemented to reinforce the investments in tourism infrastructures in order to capitalise on new market opportunities in new areas, as well as the necessary *restructuring of determined traditional destinations and products*.

The necessary *public leadership* must go hand in hand with the effort of all the companies in the tourism sector, in order to adapt their activities using cleaner technologies and logistics involving a more rational energy use in order to minimise as far as possible any contribution to climatic change (WTO 2003).

To all of this we must add that it is becoming necessary to orient research towards the *interpretation of possible future scenarios* related to climate, in order to learn of the most likely impacts on tourism (dealt with in the following section). Public incentive is needed to carry out studies aimed at exploring the possible strategic responses of the tourism industry and identifying new expansion opportunities for the markets, joining together public policy makers of tourism, research, private sector and climate experts, who are usually the most productive.

## 14.10. MAIN RESEARCH NEEDS

This report is of a preliminary nature and its objective is to evaluate the foreseeable impact of climate change on tourism, and also to establish how much knowledge exists regarding the theme and to detect the needs for research, *identifying critical knowledge gaps*, which should be dealt with in the future, and to propose future sectorial or integral research projects, both for whole sectors and for determined geographic areas. This section presents the arguments related to research in the future, in order to objectify the available knowledge and to reduce the uncertainties related to the impact of climate change on tourism in Spain, with the premise of establishing *adaptational strategies* while avoiding alarmism.

As an initial answer, it could be said that *there is little research in Spain into the relationship between climate change and tourism*. The theme is currently in the expectant phase, people are becoming more aware of its importance, but there are still no scientific studies on the possible impacts of climate change on tourism in Spain. Studies by the IPCC and by the UNO, and others associated to these, are being echoed in the media on our country, which is helping to disseminate information about these problems. The institutions and promoters of knowledge of the theme are awaiting confirmation of the scope of climate change (the Third Evaluation Report in 2001 by the IPCC provides data on the verification of this) and of its consequences, in order to take decisions and to implement the corresponding actions. Following an initial phase aimed at defining the problem, the scientific community is beginning to formulate specific objectives and to design methodologies aimed at objectifying the dimension of change and of the specific impacts within each sphere.

Both the research needs and the critical knowledge gaps are projected into the different development phases of the phenomenon and of the research process itself. Consequently, the lack of knowledge and the needs for research are identified in the different sections of this Report and in the different items developed in each case, as well as in the *different elements of the Tourism System*: demand, supply, market operators and the geographic-tourism space, particularly in the latter, due to the fact that it encompasses the natural resources with potentiality for tourism and, specifically, atmospheric resources.

In relation to the phases of the study of the phenomenon and its consequences, it should be pointed out that the existence of climate change has been noted throughout the XX century, and that the IPCC has made new predictions about what the climate will be like in the XXI century, basing scenarios of climatic change on trustworthy estimates of the changes observed (likely, very likely,...) and identifying the effects of the change: impacts, adaptation and vulnerability. In order to guarantee the quality level of the IPCC reports, (and to attain greater levels of certainty for trustworthy estimates of the changes observed), *it is necessary to support the research programmes* and to maintain and improve the *networks of systematic observation of the climate* and to implement studies related to the modelling and the physical processes of the climate system.

With regard to the relationship between climate change and tourism, it must be pointed out that there are *research needs* related to:

- The *role played by the present climate in the Spanish tourism system* (see section 14.2 of this Report, dealing with sensitivity to the present climate).
- The *impacts of climate change on tourism*: repercussions for the geographic-tourism space, for supply and demand in tourism, and for the market operators (see section 14.3, on impacts of climate change on the tourism sector).
- Evaluation at different territorial scales and demarcation of *critical and vulnerable zones* (see section 14.4, on the most vulnerable zones).



- The *repercussions for other sectors*, given the transversal nature of tourism; identifying the repercussions for the inputs into tourism (see section 14.6, on repercussions for other sectors or areas).
- The creation of *systems of indicators* in the sector for the detection of change (see sections 14.7 and 14.8, dealing with the main uncertainties and knowledge gaps and the possibilities of detecting change).
- The design of *management models* aimed at optimising the adaptational options and implications for instrumental and regional policies and those related to tourism (see sections 14.5 and 14.9, dealing with the main adaptational options and implications for policies).

In order to structure and to make the aforementioned orientations viable, the following *proposals* were formulated:

1. To incorporate into the present statistics systems and indicators of tourism and the associated activities, *new variables related to the climate/tourism relationship* and the relationship between climate change and tourism. For example, in the System of Environmental Indicators for Tourism (Environment Ministry), in the Statistics System of the General Dept. of Tourism or in other data processing systems related to tourism at national and regional scale.
2. To create a *System of Indicators of the Climate Change-Tourism Relationship*, in order to measure the scope of the impacts of climatic change in the Spanish tourism system. It should integrate indicators, variables or items of all the elements of the tourism system (demand, offer, geo-tourism space, operators), in order to evaluate objectively and in an integral way the impact of climate change and to avail of information for decision-taking. The deficiencies detected indicate the need to identify valid variables and to organise measurement with the corresponding protocol of interpretation and dissemination (designing a data network that considers territorial cover and temporal cover). An analytical approach to the incidence of climatic change on tourism in Spain must contemplate multiple aspects. However, for the sake of operativeness, there should be a simplification of the identification of unique occurrences and reference variables. The system of indicators must include impact indicators, indicators of adaptational capacity and vulnerability indicators, among others.
3. The aforementioned System of Indicators must be based on a series of conditions. The instrumental value of a system of indicators is subject to the fulfilment of a series of prerequisites in the selection and creation of the indicators. The Systems of Indicators must contemplate the *different scales of manifestation of the phenomenon*. The prerequisites are identified according to the different phases of the information gathering process, methodological consistency, scientific validity, application and communication.
4. *Institutionalisation of the promotion and funding of research into climatic change and tourism*. Due to the horizontal and inter-sectorial nature of tourism, and to the structural nature of the dialectics on the climate change-tourism relationship, a specific line for funding for research projects needs to be opened up and maintained, with programmes dealing explicitly with this problem, to be integrated into Plan Nacional de Investigación y Desarrollo e Innovación (PN I+D+I) – (national research, development and innovation plan).

#### 14.11. BIBLIOGRAPHY

- Alonso Fernández J. 1979. Valoración climática de las costas turísticas españolas. Boletín de la Real Sociedad Geográfica, t. CXII (1): 7-20.
- Banco de España 2004. Boletín Estadístico. Madrid. Banco de España.
- Barbière E.B. 1981. O fator climatico nos sistemas territoriais de recreação. Revista brasileira de geografia, t. XLIII (2): 145-265.

- Baretje R. and Crespo B. 1992. *Tourisme. Climatologie. Meteorologie. Essai Bibliographique.* Aix-en-Provence. Centres des Hautes Etudes Touristiques.
- Besancenot J.P., Mounier J. and Lavenne F. De 1978. Les conditions climatiques du tourisme littoral. un méthode de recherche compréhensive. *Norois*, t. XXV (99): 357-382.
- Burnet L. 1963. *Villégiature et tourisme sur les côtes de France.* Paris. Hachette.
- Cerezuela F. and Ayala L. 1987. *Bioclimatología turística de la Costa del Sol.* Málaga. Sección de Publicaciones de la Universidad de Málaga, Diputación Provincial de Málaga y Caja de Ahorros de Ronda.
- Crowe R.B., Mckay G.A. and Baker W.M. 1977a. Le climat de l'Ontario et son influence sur le tourisme et les loisirs de plein air. Volume I, Objectif et définitions des saisons. Environnement Canada, Service de l'environnement atmosphérique. Toronto. Publications en météorologie appliquée, REC-1-73.
- Crowe R.B., Mckay G.A. and Baker W.M. 1977b. Le climat de l'Ontario et son influence sur le tourisme et les loisirs de plein air. Volume II, Été. Environnement Canada, Service de l'environnement atmosphérique. Toronto. Publications en météorologie appliquée, REC-1-73.
- Crowe R.B., Mckay G.A. and Baker W.M. 1977c. Le climat de l'Ontario et son influence sur le tourisme et les loisirs de plein air. Volume III, L'Hiver. Environnement Canada, Service de l'environnement atmosphérique. Toronto. Publications en météorologie appliquée, REC-1-73.
- Davis N.E. 1968. An optimun summer weather index. *Weather*, t. XXIII (8): 144-146.
- De Freitas C.R. 2001. Theory, concepts and methods in Tourism Climate Research. In: Matzarakis A. and De Freitas C.R. (eds.). *Proceedings of the First International Workshop on Climate, Tourism and Recreation.* International Society of Biometeorology. Pgs. 3-20.
- Esteban Talaya A. 2003. Tendencias de la demanda turística en España, *La Actividad Turística Española en 2002*, AECIT: 43-60.
- Flocas A.A. 1975. Winter and summer indices in Athens. *Scientific Annals of the Faculty of Physics and Mathematics, Aristotelian University of Thessaloniki*, t. XV: 247-264.
- Gómez Martín M<sup>a</sup> B. 1999a. La relación clima-turismo. consideraciones básicas en los fundamentos teóricos y prácticos, *Investigaciones Geográficas* 21: 21-34.
- Gómez Martín M<sup>a</sup> B. 1999b. El Clima como activo del turismo. los folletos turísticos catalanes, In: *El Territorio y su Imagen*, Vol. I. Pub. Universidad de Málaga y Consejería de Medio Ambiente de la Junta de Andalucía, Málaga. Pgs. 515-526.
- Gómez Martín M<sup>a</sup> B. 2000. Clima y turismo en Cataluña. Evaluación del potencial climático-turístico de la estación estival. Tesis Doctoral inédita, Dpto. Geografía Física y Análisis Geográfico Regional, Universidad de Barcelona.
- Gómez Martín M<sup>a</sup> B. 2004a. Duración y características de la estación climático-turística estival en Cataluña, *Estudios Geográficos*, CSIC. (in press).
- Gómez Martín M<sup>a</sup> B. 2004b. Percepción de la demanda y métodos de evaluación de la potencialidad turística de los recursos atmosféricos en Cataluña. *Documents d'Anàlisi Geogràfica* (in press).
- Gómez Martín M<sup>a</sup> B. 2004c. An evaluation of the tourist potential of the climate in Catalonia (Spain): a regional study. *Geografiska Annaler*. Blackwell Publishing (in press).
- Gómez Martín M<sup>a</sup> B. 2004d. Weather, climate and tourism. a geographical perspective, *Annals of Tourism Research*, Pergamon, Elsevier (en proceso de evaluación).
- Gómez Martín M<sup>a</sup> B. 2004e. Reflexión geográfica en torno al binomio clima-turismo, *Boletín de la Asociación de Geógrafos Españoles*, AGE (en proceso de evaluación).
- Gómez Martín M<sup>a</sup> B. and López Palomeque F. 2003. Destinos de montaña y nieve, en *La actividad turística española en 2002 edición 2003*, AECIT, Madrid. Pgs. 427-438.
- Gómez Martín M<sup>a</sup> B., López Palomeque F. and Martín-Vide J. 2002. Aptitud climática y turismo. Variaciones geográficas y cronológicas de la potencialidad climático-turística del verano en Cataluña, *Ería* 59: 333-345.
- Hughes G.H. 1967. Summers in Manchester. *Weather*, t. XXII (5) : 199-200.

- Instituto de Estudios Turísticos. 2004a. Movimientos turísticos de los españoles (Familitur). Año 2003. Madrid. Secretaría de Estado de Turismo y Comercio, Ministerio de Industria, Turismo y Comercio.
- Instituto de Estudios Turísticos. 2004b. Movimientos Turísticos en Fronteras. (Frontur). Año 2003. Madrid. Secretaría de Estado de Turismo y Comercio, Ministerio de Industria, Turismo y Comercio.
- Instituto Nacional de Estadística 2004. Encuesta de Ocupación Hotelera. Año 2003. Madrid. INE.
- IPCC. 2001. Climate Change 2001. The Scientific Basis. Cambridge University Press. 994 pgs
- López Palomeque F. 1997. Turismo de invierno y estaciones de esquí en el Pirineo Catalán, *Investigaciones Geográficas*, 15: 19-39.
- López Palomeque F. and Vera Rebollo F. 2002. Espacios y destinos turísticos, en *Geografía de España* : 545-571, Editorial Ariel, Barcelona.
- Maddison D. 2001. In search of warmer climates?. The impact of climate change on flows of British tourists. *Climatic Change* 49: 193-208.
- Marchand J.P. 1986. Tourisme et contraintes climatiques. L'exemple irlandais. *Bulletin de l'Association de Géographes Français*, t. LXIII (5): 369-374.
- Mieczkowski Z. 1985. The tourism climatic index: a method of evaluating world climates for tourism. *The Canadian Geographer/Le Géographe canadien*, t. XXIX (3): 220-233.
- Mings R.C. 1978. Climate and Tourism Development: an annotated bibliography. *Climatological Publications. Bibliography Series. 4. State Climatologist for Arizona, Tempe.*
- Olcina Cantos J. 1994. Riesgos climáticos en la Península Ibérica. Madrid: Acción Divulgativa S.L.
- Olcina Cantos J. and Vera Rebollo F. 1998. La propaganda del clima de Alicante a finales del siglo XIX. Las obras de promoción turística como fuente para el estudio del clima de la ciudad. In: Fernández García F., Galán E. and Cañada R. (coord.). *Clima y ambiente urbano en ciudades ibéricas e iberoamericanas*. Editorial Parteluz, Madrid : 357-370.
- Parry M. (ed.) 2000. *Assessmen tof Potential Effects and Adaptations for Climate Change in Europe ACACIA*, University of East Anglia, Norwich.
- Perry A. 1972. Weather, climate and tourism». *Weather*. t. XXVII (5): 199-203.
- Perry A. 2001. More heat and drought - Can Mediterranean tourism survive and prosper? In: Matzarakis A. and De Freitas C.R. (eds.). *Proceedings of the First International Workshop on Climate, Tourism and Recreation*. International Society of Biometeorology. Pgs. 35-41.
- Perry A. 2003. Impacts of climate change on tourism in the Mediterranean. En : Giuponi C., Schechter M. and Elgar E. (eds.). *Climate Change in the Mediterranean: socio-economic perspectives of impacts, vulnerability and adaptation*. Pgs. 279-289.
- Poulter R.M. 1962. The next few summers in London. *Weather*, t. XVII (8): 253-257.
- Sarramea J. 1980. Un indice climatico-marin pour quelques stations balneaires françaises. *Annales de Géographie*, t. LXXXIX (495): 588-604.
- Scott D. and Mcboyle G. 2001. Using a modified tourism climate index to examine the implications of climate change for climate as a tourism resource. In: Matzarakis A. and De Freitas C.R. (eds.). *Proceedings of the First International Workshop on Climate, Tourism and Recreation*. International Society of Biometeorology. Pgs. 69-89.
- Scott D., Mcboyle G., Mills B. and Wall G. 2001. Assessing the vulnerability of the alpine skiing industry in Lakelands Tourism Region of Ontario (Canada) to climate variability and change. In: Matzarakis A. and De Freitas C.R. (eds.). *Proceedings of the First International Workshop on Climate, Tourism and Recreation*. International Society of Biometeorology. Pgs. 153-170.
- Smith K. 1993. The influence of weather and climate on recreation and tourism. *Weather* 48 (12): 398-404.
- Vera Rebollo J.F. 1985. Las condiciones climáticas y marítimas como factores de localización del turismo histórico alicantino. *Investigaciones Geográficas* 3: 161-178.
- Vera F., López Palomeque F., Marchena M. and Antón S. 1997. *Análisis Territorial del Turismo*, Editorial Ariel, Barcelona.
- Viner D. and Agnew M. 1999. *Climate Change and Its Impacts on Tourism*, University of East Anglia, Norwich.

World Tourism Organization 2003. Climate Change and Tourism, Proceedings of the First International Conference on Climate Change and Tourism, Organización Mundial del Turismo, Madrid.